UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Mr. Warren Climo
Director, Environmental Management
Hilmar Cheese Company
9001 North Lander Avenue
Hilmar, CA 95324

Re: Technical Review
Class I Underground Injection Control (UIC) Permit Application

Dear Mr. Climo:

The United States Environmental Protection Agency, Region 9 (EPA) is conducting the Technical Review of Hilmar Cheese Company's (HCC) Class I UIC permit application to inject nonhazardous industrial waste. The Technical Review evaluates the information you provided for your permit application.

Outlined below is additional information, and clarification of previously submitted information, that we need to continue our review of your application.

Injection Volume

1. **In Section 7.B (and other areas) of the permit application, it is disclosed that HCC proposes to inject a maximum of 2,205,000 gallons of wastewater per day. However, Section 13.A states the maximum anticipated daily injection volume is 12,000 barrels (504,000 gallons) of wastewater. Please note that federal UIC permits are designed around the permitted facility's maximum injection volume. Please clarify this volume discrepancy or describe the anticipated alternative disposal method for the wastewater that would not be disposed through underground injection.**

2. **Disclose all information used to determine the number of injection wells needed to inject the proposed volume of wastewater. This response should include information on the historical performance of wells that inject fluids into the Paleocene-Cretaceous sand formation (the proposed injection formation) in the vicinity of the proposed project site.**

Waste Front Radius and Pressure Front Calculations

3. It appears the waste front radius and pressure front calculations from Attachment 16 were plotted individually on Attachment 2's Base Map for the Area of Influence. Pressure transient models for injection wells in close proximity are additive and should be calculated and plotted accordingly. Please either 1) verify that Attachment 2's Base Map for the Area of Influence is based on additive pressure transient calculations, or 2) create a new Base Map for the Area of Influence representing a plot of additive pressure transient calculations for all injection wells proposed in this permit.

4. Expand upon the justification provided in the application for using the permeability value of 500 millidarcies in the pressure transient calculations for the Paleocene-Cretaceous sand formation.

Compliance History

5. Summarize all Orders, violations of those Orders, and any other enforcement actions that were issued to HCC by a State or local regulatory agency prior to December, 2004.

6. Provide a list of all pending or existing operating permits issued to HCC by a State or local regulatory agency prior to December, 2004.

Fracture Gradient

7. You used a fracture gradient of 0.80 psia/ft for the Paleocene-Cretaceous sand formation in Section H.7 of the application. We will require that HCC conduct a step rate test to establish maximum injection pressure. Please submit your proposal for conducting the step rate test.

Sludge Disposal

8. Section 15.C of the Permit Application states that there will be no disposal of sludge or hazardous materials as a result of surface treatment of the process wastewater. However, Section 2.1.9 of Attachment 26 discloses that "two composting facilities and the digester at EBMUD" will be employed to accept the biosolids from the surface treatment facilities. Please provide the names of these facilities.

Please submit this information to:

Eric Byous
Ground Water Office (WTR-9)
USEPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

Please send a copy your response (as well as all future correspondence sent to USEPA Region 9 regarding this permit) to:

Alexis R. Phillips-Dowell
Central Valley RWQCB
1685 E Street
Fresno, CA 93706

Glenn Muggelberg
District 5
California Division of Oil, Gas, and Geothermal Resources
478 Green Street
Coalinga, CA 94133

Please call Eric Byous at (415) 972-3531 or me at (415) 972-3971 if you have any questions regarding this letter.

Sincerely,

David Albright
Manager, Ground Water Office
February 7, 2005

cc: Glenn Muggelberg, CDOGGR
Alexis R. Phillips-Dowell, CVRWQCB

February 25, 2005

Mr. Eric Byous
Ground Water Office (WTR-9)
USEPA Region 9
75 Hawthorne Street
San Francisco, California 94105

Subject: Response to Questions from the Technical Review of the Class I Underground Injection Control (UIC) Permit Application – February 7, 2005

Dear Mr. Byous:

In response to the questions raised in your letter dated February 7, 2005, we have prepared the information below. The responses are numbered to align with the same numbers as your questions.

Injection Volume

1. A maximum injection rate of 2,205,000 gallons per day (GPD), or 13,125 bbls per day (BPD) is anticipated. Attachment 1 includes revised pages 2, 17, 20, 21, and 30 of the Hilmar Cheese Company UIC Permit Application, which contains information related to maximum injection rate data.

2. No known injection wells are located within about a 10-mile radius of the project area (Department of Conservation, 2005). Because the Paleo-Cretaceous section is highly variable in this region of the San Joaquin Basin, injection wells located outside of this area were considered not likely to have comparable geologic/engineering characteristics. The number of injection wells was determined based on known characteristics of and assumptions about the proposed injection zone, as discussed and referenced in the Hilmar Cheese Company UIC Permit Application. If additional injection capacity is required, new wells will be permitted through the EPA.

Waste Front Radius and Pressure Front Calculations

3. Attachment 2 of the Hilmar Cheese Company UIC Permit Application shows the area of influence for the waste front after 30 years using a maximum injection rate of 13,125 bbls per day. Attachment 3 and Attachment 4 show the revised pressure front based on the maximum injection rate.

9001 North Lander Ave. • P.O. Box 910 • Hilmar, CA 95324 • (209) 667-6076 • Fax (209) 634-1408

4. The geologic study for the Hilmar Cheese Company project area included a review of 17 deep wells within about 36 square miles of the site. Permeability data in this area were not available through conventional sources, such as core analyses. Instead, data from analogous, Late Cretaceous zones in surrounding gas fields were used to determine an estimated permeability of 500 md for the proposed Paleo-Cretaceous injection zone. The following table provides information about data sources reviewed for the permeability estimate.

Field	Zone	Permeability	Avg. Depth	Reference
Merrill Avenue	Blewett	20 - 1,700	6,600 ft	Attachment 5
McMullin Ranch	Blewett	597 md	4,525 ft	Attachment 6
	Tracy	117 md	6,005 ft	
Vernalis	Blewett	70 - 320	3,800 ft	Attachment 7
Southwest Vernalis		No data		
Chowchilla	Domengine	No data		
Ash Slough		No data		
Mint Road		No data		

An average of permeability of 442 md was determined using the above data. However, except for the Vernalis field, permeability data from Late Cretaceous producing zones were from 425 to 3,250 ft deeper than the proposed Paleo-Cretaceous injection zone at the Hilmar site. The relation between increasing depth and decreasing permeability, resulting primarily from sediment compaction and thermal effects, is well established. Therefore, an estimated permeability of 500 md was considered to be reasonable and used in the waste front/pressure front calculations.

It should be noted that permeability from the site will be determined from analyses of sidewall core samples, which will be collected during drilling of the first proposed injection well.

Compliance History

5. **April 28, 2000** – Hilmar Cheese Company submits RWD 2000 for discharge of 1.25 mgd of wastewater.

   August 30, 2000 – RWQCB issues a NOV relating to wastewater treatment deficiencies, permit requirements and related nuisance conditions.

February 1, 2001 – Hilmar Cheese Company submits RWD 2001 to RWQCB for discharge of 1.5 mgd of wastewater.

February 22, 2001 – RWQCB issues a NOV for failing to comply with aspects of the Monitoring and Reporting program, failing to comply with Standard Provisions and Reporting Requirements for the WDR and failing to submit documents with the requisite certification statement.

March 20, 2001 – RWQCB issues a NOV for the discharge of reverse osmosis reject to primary land disposal areas.

July 18, 2003 – RWQCB issues a violation letter requiring an update of wastewater processing, plans for changes to the system, control of nuisance, and groundwater data omissions.

February 25, 2004 – RWQCB issues a NOV for pond embankment erosion control, secure operation of field sampling station, supply of calibration certificates, security of monitoring wells, supply of revised primary field maps, revision of data for TKN.

August 3, 2004 – RWQCB issues a NOV requiring documentation of fly and odor control measures, a storm water pollution prevention plan, and RWD submission.

December 2, 2004 – RWQCB issues a CAO relating to excess salinity discharge to land requiring a sampling plan of local domestic wells and a new groundwater study to identify the extent of possible groundwater contamination from this salinity.

6. **October 17, 1997** - WDR Order 97-206 issued by RWQCB.

Fracture Gradient

7. A proposal for the step rate test on the Hilmar Cheese Company injection wells is provided in Attachment 8.

Sludge Disposal

8. Currently, one main outlet is being used for offsite disposal of materials from the wastewater treatment plant. This is the East Bay Municipal Utility District's facility at Oakland (EBMUD). A second outlet, Synagro West Inc. at El Nido, has agreed to take materials and Hilmar Cheese Company is currently waiting for a formalized contract to be submitted by them for approval. The details for these two sites are as follows:

- **EBMUD** - This treatment plant has an NPDES permit issued by the California Regional Water Quality Control Board, San Francisco Bay Region, Order No. 01-072, NPDES Permit No. CA0037702.

- **Synagro** - Synagro West Inc. (Synagro) is the operator of the El Nido composting facility. The relevant permits are: SWFP Number - 24-AA-0011, WDR Number - R5-2003-0180, Merced County CUP Number - 01007 and Minor Modification No. 04006.

A second composting facility is being investigated at this time to act as a back-up to the two facilities named above. If and when this facility can also be used for disposal of materials from the treatment plant, details of the operation will be forwarded to EPA.

If you need any further information or clarification of this information, please contact either Donna Thompson of San Joaquin Energy Consultants, Inc. at (661) 395-3029 or me at (209) 656-2294.

Yours faithfully,

Warren J. Climo
Director – Environmental Management

WJC:mkm

Enclosures:
References
Attachments 1 - 8

cc: Alexis R. Phillips-Dowell (CVRWQCB)
Glenn Muggelberg (CDOGGR – District 5)
Donna M. Thompson

REFERENCES

California Department of Conservation, 1998. *California Oil Fields, Central California*: Division of Oil and Gas, and Geothermal Resources, Publication TR11, vol. 1, Sacramento.

California Department of Conservation, 1981. *California Oil Fields, Northern California*: Division of Oil and Gas, and Geothermal Resources, Publication TR10, vol. 3, Sacramento.

Hunter, W. J., and G. W. Beecroft, 1960. "McMullin Ranch Gas Field," *Summary of Operations, Calif. Oil Fields*, Vol. 46, No. 2, California Division of Oil, Gas, and Geothermal Resources, Sacramento.

Hill, F. L., 1962. "Vernalis Gas Field," *Summary of Operations, Calif. Oil Fields*, Vol. 48, No. 2, California Division of Oil, Gas, and Geothermal Resources, Sacramento.

LIST OF ATTACHMENTS

Attachment 1: Revised Pages from Hilmar Cheese Company UIC Permit Application

Attachment 2: Waste Front Calculations and Map: Single Well and Maximum Anticipated Injection Volume

Attachment 3: Pressure Front Calculations: Single Well and Maximum Anticipated Injection Volume

Attachment 4: Pressure Front Map

Attachment 5: Geologic Data for the Merrill Avenue Gas Field (Department of Conservation, 1998)

Attachment 6: Geologic Data for the McMullin Ranch Gas Field (Department of Conservation, 1981)

Attachment 7: Geologic Data for the Vernalis Gas Field (Department of Conservation, 1981)

Attachment 8: Hilmar Cheese Company Injection Well Step Rate Test Procedure

ATTACHMENT 1

Revised Pages from Hilmar Cheese Company UIC Permit Application

D. Project type (cogeneration, refinery, industrial treatment, commercial disposal, etc.):

Industrial waste treatment process for dairy factory.

E. Operating status of other well(s) on site:

Wells within 0.5 mile of the proposed injection wells are shown on maps included in Attachment 1 through Attachment 3.

2. DATA: WELLS WITHIN AREA OF REVIEW

Volumetric and pressure front calculations indicate that the area of influence for this project is a 1,433-ft radius around each proposed injector, with no dispersion, and a 1,584-ft radius with dispersion. The area of review for this project was a 2,640-ft radius, or a 0.5-mile radius, around each injector (Attachment 1). Additional discussion of area of influence calculations is provided in Section 8 of this permit application.

Attachment 3 includes a location map of the wells, summary table of well data, well owner information, and, if available, well construction data, histories, and logs for wells within the area of review. Oil and gas well data are available to the public and included in Attachment 3. Information on water wells and other privately-owned wells is confidential and available only if authorized for release by their owners.

A. Legal contact(s) (names and addresses):

Hilmar Cheese Company
9001 North Lander Avenue
P. O. Box 910
Hilmar, California 95324
Telephone: (209) 667-6076
FAX: (209) 634-1408

All legal contact information for other wells is included in Attachment 3.

(Attachment 16), the average rate of injectate migration, with dispersion, was calculated using the following formula:

Average migration rate = (Distance of waste-front)/(time)

No. of Years	Distance (ft)	Average Rate (ft/yr)
1	326	326
5	682	136
10	942	94
20	1,307	65
30	1,584	53

F. TDS (salinity) profiles:

TDS profiles in the proposed injection zone are shown on the type log for the project area (Attachment 5) and on the geologic cross-sections (Attachment 9).

G. Specific gravity or density:

The density of a sample of formation water in the proposed injection zone will be provided after a sample is collected during drilling the first well.

H. Temperature and pH:

Temperature within the proposed injection zone is estimated to range from 128°F to 142°F based on an average annual surface temperature of 61.8°F for the Hilmar area (www.worldclimate.com, 2004) and a geothermal gradient of 2°F/100 ft. A temperature gradient graph based on a plot of bottom-hole temperatures in nearby wells indicates a range of 110° F to 120°F (Attachment 17; Pacific Geotechnical Associates, 2004b).

The pH of the formation water in the proposed injection zone will be provided after a sample is collected during drilling the first well.

F. Compatibility of waste stream with receiving formation:

Although incompatibility of injectate and receiving groundwater is not anticipated, a compatibility analysis will be done.

G. Density:

The density of the discharge is expected to be 1.0 to 1.1 g/cm^3. The range is expected because of variability in the concentration of minerals and the addition rate of the secondary sources.

8. AREA OF REVIEW

A. One-half mile radius or area of influence, based on stratigraphy, whichever is greater:

The 0.5-mile area of review is greater than the area of influence, which was calculated to be about 1,584 ft, including dispersion. See Attachment 2 for the area of influence map and Attachment 16 for area of influence calculations.

B. Zone of endangering influence over design life expectancy of well for both the pressure front and the waste front:

1. Volumetric method:

Waste front radius at 30 years = 1,433 ft without dispersion.
Waste front radius at 30 years = 1,584 ft with dispersion.

See Attachment 16 for calculations. Please note that the waste front radii have been calculated using a conservative porosity of 25%. It was assumed that four injection wells would dispose of 13,125 barrels (bbls) per day per well.

2. Pressure build-up method (e.g., modified Theis equation):

Pressure increase at 30 years and radius of 1,500 ft = 37.28 psia (= 8.6 ft of head). See Attachment 16 for pressure front calculations.

C. Calculation of dispersion or migration through the confining layer:

Negligible at injection pressure.

D. Modeling (if applicable, including model documentation):

Not applicable.

E. Narrative description, calculation, and list of assumptions for each method:

Waste front calculations in Attachment 16 used methods described in Warner and Lehr (1981; pp. 107-114). Pressure increases were calculated using superposition in an infinite-acting reservoir, assuming no fluid withdrawal. The calculations also assumed a 30-year service life for project and an average injection rate of 13,125 bbls per day per well.

F. Potential impact of injection upon wells within area of review (i.e., due to pressure build-up):

***None.* There are *no significant impacts within the area of review (see Theis* calculation).**

9. INJECTION WELL CONSTRUCTION

Four injection wells are proposed for the Hilmar Cheese Company project: Approximate locations for the wells are as follows (Attachment 1and Attachment 2):

Well No.	Latitude	Longitude	From N/S Line (ft)	From E/W Line (ft)
HCC-WD-1	37°25.144' N	120°51.253' W	75	1,585
HCC-WD-2	37°25.529' N	120°51.551' W	2,385	2,280
HCC-WD-3	37°25.146' N	120°51.810' W	75	1,025
HCC-WD-4	37°25.359' N	120°52.357' W	1,175	1,585

The proposed injection wells will be constructed after issuance of a final UIC permit for the facility. An area permit is requested for the four proposed Hilmar wells and may be granted at the discretion of the EPA Director.

2. Injection zone (total unit and net sand):

See Attachment 10 for an isochore map of the Paleocene-Cretaceous sands in the proposed injection zone.

H. Area of review (on topographic map showing proposed and existing well locations). Illustrate area(s) of influence as calculated by the following methods for both pressure front and waste front)

1. Quarter mile radius or area of influence, whichever is greater:

See Attachment 1 and Attachment 2.

2. Pressure build-up method for both individual and multiple well operations.

See Attachment 1 and Attachment 16.

3. Volumetric method.

See Attachment 1 and Attachment 2.

4. Modeling output (if appropriate).

Not applicable.

I. A map showing all wells within one-mile radius of the proposed injection well(s) that produce oil or gas from the injection zone and/or confining zone.

See Attachment 1 through Attachment 3.

13. OPERATING DATA

A. Injection rate (average and maximum, in barrels per day and million gallons per day) and describe any daily or seasonal variations:

The maximum anticipated injection rate is 13,125 barrels of water per day.

ATTACHMENT 2

Waste Front Calculations and Map: Single Well and Maximum Anticipated Injection Volume

Waste Front Radius Calculation:
Single Well and Maximum Anticipated Injection Volume

Company: **Hilmar Cheese Company**
Zone: **Paleocene-Cretaceous Sands**
Field: **N/A**
Well No. **Hilmar Cheese Company Class I Injection Wells**
No. Wells: **4**

Q (BPD): **13,125**
Net H (ft): **500**
Porosity: **25.0%**

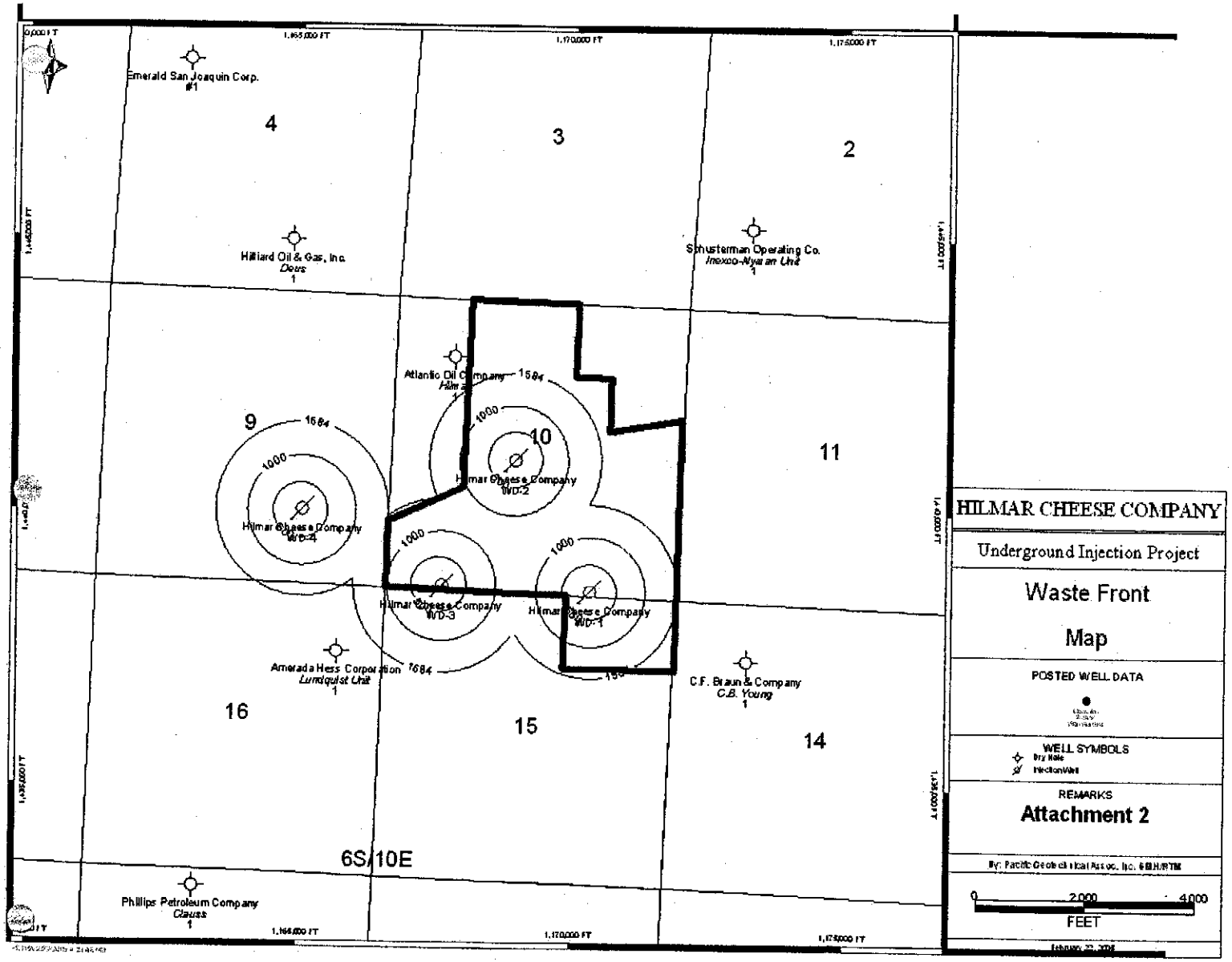
Time, years	Injection Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Waste Radius with No Dispersion (ft)	Waste Radius with Dispersion (ft)	Wastefront Rate with Dispersion (ft/yr)
1	26,897,252	26,897,252	262	326	326
2	26,897,252	53,794,503	370	447	223
3	26,897,252	80,691,755	453	538	179
4	26,897,252	107,589,006	523	615	154
5	26,897,252	134,486,258	585	682	136
6	26,897,252	161,383,509	641	742	124
7	26,897,252	188,280,761	692	797	114
8	26,897,252	215,178,012	740	849	106
9	26,897,252	242,075,264	785	897	100
10	26,897,252	268,972,515	828	942	94
11	26,897,252	295,869,767	868	985	90
12	26,897,252	322,767,018	907	1,027	86
13	26,897,252	349,664,270	944	1,066	82
14	26,897,252	376,561,521	979	1,104	79
15	26,897,252	403,458,773	1,014	1,140	76
16	26,897,252	430,356,024	1,047	1,176	73
17	26,897,252	457,253,276	1,079	1,210	71
18	26,897,252	484,150,527	1,110	1,243	69
19	26,897,252	511,047,779	1,141	1,275	67
20	26,897,252	537,945,030	1,170	1,307	65
21	26,897,252	564,842,282	1,199	1,337	64
22	26,897,252	591,739,533	1,228	1,367	62
22	26,897,252	618,636,785	1,255	1,396	63
24	26,897,252	645,534,036	1,282	1,425	59
25	26,897,252	672,431,288	1,309	1,453	58
26	26,897,252	699,328,539	1,334	1,480	57
27	26,897,252	726,225,791	1,360	1,507	56
28	26,897,252	753,123,042	1,385	1,533	55
29	26,897,252	780,020,294	1,409	1,559	54
30	26,897,252	806,917,545	1,433	1,584	53
Maximum:	1,613,835,090	806,917,545	1,433	1,584	

Calculations based on Warner & Lehr, eqns 3-10, 3-11

$r = \{V/(pi*h*phi)\}^{0.5}$
$r' = r+2.3*(D*r)^{0.5}$

Where:
r = radial distance of wastewater front from well
r' = radial distance of wastewater front from well with dispersion
V = cumulative wastewater injection in cubic feet
pi = 3.1416
h = net reservoir thickness
phi = average effective porosity
D = dispersion coefficinet; 3' for sandstone; 65' for limestone/dolomite

Note: Porosity calculated from sonic log = 28.8% (Pacific Geotechnical Associates, 2004b)



HILMAR CHEESE COMPANY

Underground Injection Project

Waste Front Map

POSTED WELL DATA

WELL SYMBOLS

Dry Hole

Injection Well

REMARKS

Attachment 2

By: Pacific Geotechnical Assoc. Inc. 6/8/07

0 2,000 4,000

FEET

February 23, 2006

ATTACHMENT 3

Pressure Front Calculations: Single Well and Maximum Anticipated Injection Volume

Pressure Front Calculation:
Single Well and Maximum Anticipated Injection Volume
Pressures at 30 Years

Company: **Hilmar Cheese Company**
Zone: **Paleocene-Cretaceous Sand**
Field: **N/A**
Well No: **Hilmar Cheese Company Class I Injection Wells**

Q (BPD):	**13,125**	h (ft):	**500**
Porosity:	**25.0%**	t (years):	**30**
Uw (cp):	1	Ct:	**5.90E-06**
k (md):	**500**		

Radius, ft	Delta P, psi
4,000	30.01
3,500	31.00
3,000	32.14
2,500	33.50
2,000	35.15
1,500	37.28
1,000	40.29
750	42.42
500	45.43
250	50.57
100	57.36
1	91.51

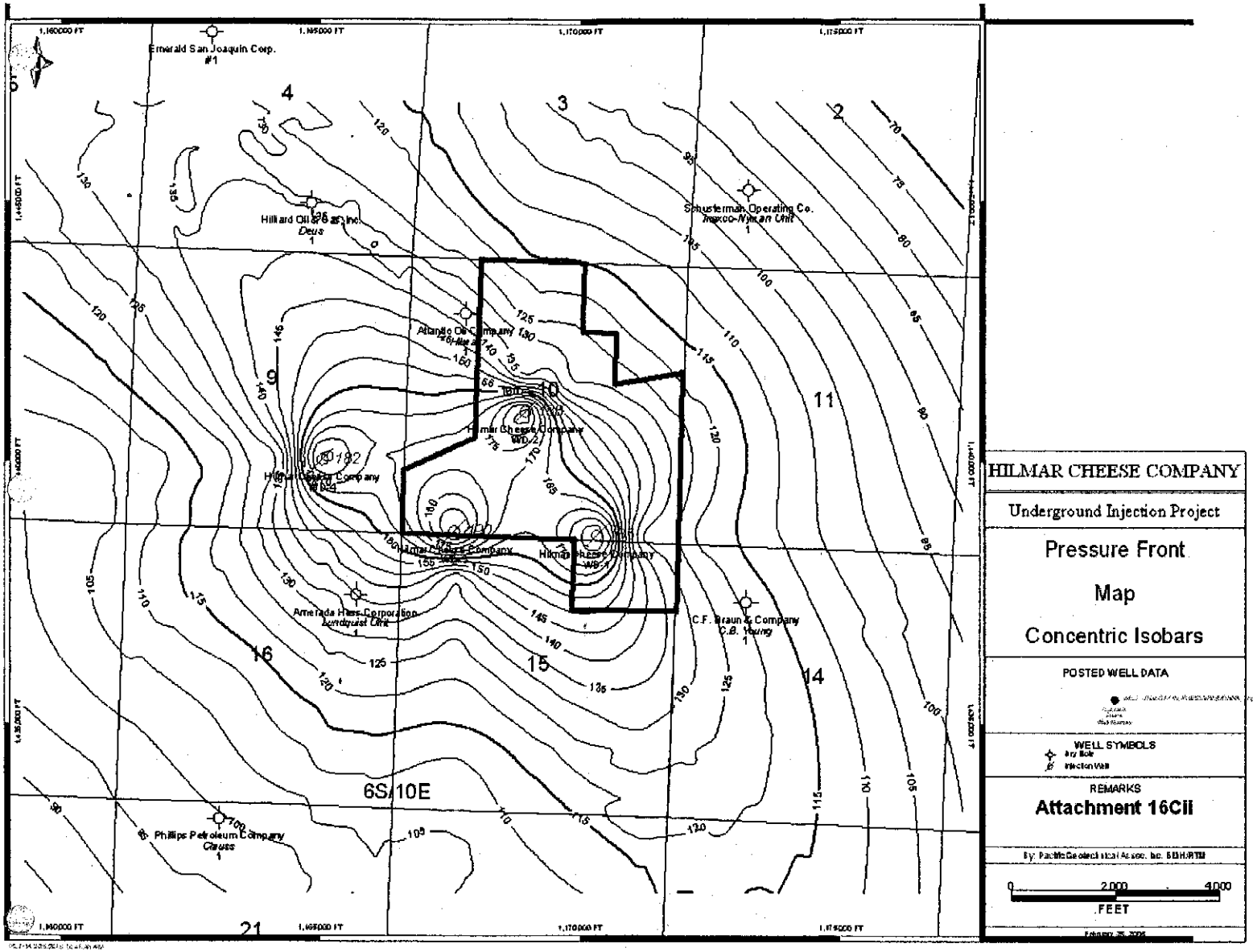
Calculations based on Warner & Lehr; eqn 3.9a

Delta P = {(162.6*Q*Uw)/(k*h)}*{log(k*t)/(phi*Uw*Ct*r^2)-3.23}

Where: Delta P = psi reservoir pressure change at radius r (ft) and time t (years).
Q = injection rate, BPD
Uw = injectate viscosity, centipoise
k = reservoir permeability
h = net thickness, ft
t = injection time, years
phi = reservoir porosity, %.
Ct = reservoir compressibility, Psi^-1
r = radius of interest, ft

ATTACHMENT 4

Pressure Front Map



HILMAR CHEESE COMPANY

Underground Injection Project

Pressure Front

Map

Concentric Isobars

POSTED WELL DATA

WELL SYMBOLS

Any Role

Injection Well

REMARKS

Attachment 16CII

By: Pacific Geotechnical Assoc. Inc. 5/31/2011

0 2,000 4,000

FEET

ATTACHMENT 5

Geologic Data for the Merrill Avenue Gas Field (Department of Conservation, 1998)

COUNTY: FRESNO AND MADERA

MERRILL AVENUE GAS FIELD

DISCOVERY WELL AND DEEPEST WELL

	Present operator and well designation	Original operator and well designation	Sec. T. & R.	B.&M.	Total Depth (feet)	Pool (zone)	Strata & age at total depth
Discovery well	Nuevo Energy Co. "O'Banion" 1	Union Oil Co. of Ca. "O'Banion" 1	25 11S 13E	MD	6,300	Blewett	Moreno Late Cretaceous
Deepest well	Same as above	"	"	"	"	"	"

POOL DATA

ITEM	BLEWETT					FIELD OR AREA DATA
Discovery date	July 1989					
Initial production rates						
Oil (bbl/day)	5,541					
Gas (Mcf/day)	2,254					
Flow pressure (psi)	18/64					
Bean size (in.)	2,930					
Initial reservoir pressure (psi)	150					
Reservoir temperature (°F)	1,500					
Initial oil content (STB/ac.-ft.)	Moreno					
Initial gas content (MSCF/ac.-ft.)	Late Cretaceous					
Formation	6,600					
Geologic age	28					
Average depth (ft.)	960					
Average net thickness (ft.)						
Maximum productive area (acres)						

RESERVOIR ROCK PROPERTIES

Porosity (%)	27-34					
So_i (%)	33-58*					
Sw_i (%)	42-67					
Sg_i (%)	20-1,700					
Permeability to air (md)						

RESERVOIR FLUID PROPERTIES

Oil:						
Oil gravity (°API)						
Sulfur content (% by wt.)						
Initial solution GOR (SCF/STB)						
Initial oil FVF (RB/STB)						
Bubble point press. (psia)						
Viscosity (cp) @ °F						
Gas:						
Specific gravity (air = 1.0)	0.623-0.665					
Heating value (Btu/cu. ft.)						
Water:						
Salinity, NaCl (ppm)	15,000					
T.D.S. (ppm)						
R_w (ohm/m) (77°F)	0.1036*					

ENHANCED RECOVERY PROJECTS

Enhanced recovery projects						
Date started						
Date discontinued						
Peak oil production (bbl)	5,356,489					
Year	1993					
Peak gas production, net (Mcf)						
Year						

Base of fresh water (ft.): 1,200

Remarks:

Selected References:

DATE: January 1998

* Calculated value

ATTACHMENT 5

ATTACHMENT 6

Geologic Data for the McMullin Ranch Gas Field (Department of Conservation, 1981)

COUNTY: SAN JOAQUIN

MCMULLIN RANCH GAS FIELD

DISCOVERY WELL AND DEEPEST WELL

	Present operator and well designation	Original operator and well designation	Sec.	T.	R.	B.&M.	Total depth (feet)	Pool (zone)	Strata & age at total depth
Discovery well	Great Basins Petroleum Co. "Signer-Perrin" 33-25	Same as present	25	2S	6E	MD	6,350	Blewett	
Deepest well	Great Basins Petroleum Co. "Occidental-Whiting" 66X-23	Same as present	23	2S	6E	MD	9,988		Panoche Late Cretaceous

POOL DATA

ITEM	BLEWETT	TRACY	E-ZONE			FIELD OR AREA DATA
Discovery date	May 1960	May 1960	June 1963			
Initial production rates						
Oil (bbl/day)	6,020	2,740	5,200			
Gas (Mcf/day)	1,725	775	2,260			
Flow pressure (psi)	3/8	3/8	5/16			
Bean size (in.)						
Initial reservoir pressure (psi)	2,415	2,900	3,625-4,120			
Reservoir temperature (°F)	140	140	172			
Initial oil content (STB/ac.-ft.)	1,200-1,500	1,400-1,800	1,400-1,600			
Initial gas content (MSCF/ac.-ft.)	Panoche	Panoche	Panoche			
Formation	Late Cretaceous	Late Cretaceous	Late Cretaceous			
Geologic age	4,525	6,005	7,200			
Average depth (ft.)	2-30	2-15	3-30			
Average net thickness (ft.)						
Maximum productive area (acres)						3,030
RESERVOIR ROCK PROPERTIES						
Porosity (%)	26-30	26-30	23-27***			
Soi (%)						
Swi (%)	30-35	30-35	35-40***			
Sgi (%)	65-70	65-70	60-65***			
Permeability to air (md)	597	117				
RESERVOIR FLUID PROPERTIES						
Oil:						
Oil gravity (°API)						
Sulfur content (% by wt.)						
Initial solution GOR (SCF/STB)						
Initial oil FVF (RB/STB)						
Bubble point press. (psia)						
Viscosity (cp) @ °F						
Gas:						
Specific gravity (air = 1.0)	.610††	.610††	.620††			
Heating value (Btu/cu. ft.)	895	895	870			
Water:						
Salinity, NaCl (ppm)	10,200	7,900	12,000-23,300			
T.D.S. (ppm)						
R_w (ohm/m) (77°F)						
ENHANCED RECOVERY PROJECTS						
Enhanced recovery projects						
Date started						
Date discontinued						
Peak oil production (bbl)						
Year						
Peak gas production, net (Mcf)						10,790,606
Year						1965

Base of fresh water (ft.): Above 500

Remarks: Dual completions from the Blewett and Tracy zones are common. Gas production from sand strings in the lower portion of the "Ragged Valley" is often commingled with Tracy zone production and considered part of the zone.

Selected References: Hunter, N. J., and Beecroft, G. W., 1960, McMullin Ranch Gas Field: Calif. Div. of Oil and Gas, Summary of Operations -- Calif. Oil Fields, Vol. 46, No. 2.

DATE: January 1981

*** Representative values for area, formation, and depth.

†† Calculated value.

CALIFORNIA DIVISION OF OIL AND GAS

ATTACHMENT 6

ATTACHMENT 7

Geologic Data for the Vernalis Gas Field (Department of Conservation, 1981)

COUNTY: SAN JOAQUIN and STANISLAUS

VERNALIS GAS FIELD

DISCOVERY WELL AND DEEPEST WELL

	Present operator and well designation	Original operator and well designation	Sec. T. & R.	B.&M.	Total depth (feet)	Pool (zone)	Strata & age at total depth
Discovery well	Chevron USA, Inc. "Blewett Comm." 1	Standard Oil Co. of Calif. "Blewett Comm." 1	14 3S 6E	MD	3,872	Blewett	
Deepest well	W. E. Strangman "Navarra" 1	Inter-American Resources Dev. Co. "Navarra" 1	29 3S 6E	MD	11,602		F-zone Late Cretaceous

POOL DATA

ITEM	BANTA	AZEVEDO	BLEWETT	"RAGGED VALLEY SILT"	TRACY	FIELD OR AREA DATA
Discovery date	September 1959	January 1959	January 1941	May 1960	July 1959	
Initial production rates						
Oil (bbl/day)	4,900	795/370 a/	9,700	1,110	5,500	
Gas (Mcf/day)	850	1,440/1,020 a/	1,140	1,000	950	
Flow pressure (psi)						
Bean size (in.)	1/2	1/8 / 5/8 a/	5/8	1/4	1/2	
Initial reservoir pressure (psi)	1,425	1,680	1,765	2,110	2,220	
Reservoir temperature (°F)	107	118	120	129	130	
Initial oil content (STB/ac.-ft.)						
Initial gas content (MSCF/ac.-ft.)	910	710-860	800-970	870	920-1,100	
Formation	Valley Sprs.-Nehrten	Moreno	Panoche	Panoche	Panoche	
Geologic age	Miocene-Pliocene	Late Cretaceous	Late Cretaceous	Late Cretaceous	Late Cretaceous	
Average depth (ft.)	3,000	3,600	3,800	4,650	4,925	
Average net thickness (ft.)	25	40	80	40	10	
Maximum productive area (acres)						4,030
RESERVOIR ROCK PROPERTIES						
Porosity (%)	30*	25-28	27-30	25*	25-28	
Soi (%)						
Swi (%)	30*	40-45	40-45	45*	40-45	
Sgi (%)	70*	55-60	55-60	55*	55-60	
Permeability to air (md)			70-320			
RESERVOIR FLUID PROPERTIES						
Oil:						
Oil gravity (°API)						
Sulfur content (% by wt.)						
Initial solution GOR (SCF/STB)						
Initial oil FVF (RB/STB)						
Bubble point press. (psia)						
Viscosity (cp) @ °F						
Gas:						
Specific gravity (air = 1.0)	.593††	.597††	.597††	.597††	.599††	
Heating value (Btu/cu. ft.)	930	920	920	920	915	
Water:						
Salinity, NaCl (ppm)	2,100	500-3,400	500-3,400	500-3,400	500-3,400	
T.D.S. (ppm)						
R_w (ohm/m) (77°F)						
ENHANCED RECOVERY PROJECTS						
Enhanced recovery projects						
Date started						
Date discontinued						
Peak oil production (bbl)						
Year						
Peak gas production, net (Mcf)						8,273,021
Year						1962

Base of fresh water (ft.): 800-1,050

Remarks:

a/ Former Blewett zone well, recompleted in January 1979 as a dual producer from two intervals in the Azevedo.

Selected References: Hill, F. L., 1962, Vernalis Gas Field: Calif. Div. of Oil and Gas, Summary of Operations -- Calif. Oil Fields, Vol. 48, No. 2.

DATE: November 1980 * Average value. †† Calculated value.

CALIFORNIA DIVISION OF OIL AND GAS

ATTACHMENT 7

ATTACHMENT 8

Hilmar Cheese Company Injection Well Step Rate Test Procedure

ATTACHMENT 8

Hilmar Cheese Company Injection Well Step Rate Test Procedure

Workover goals are to conduct a Step Rate Test to document fracture gradient in the Paleocene-Cretaceous sand formation. An injection pressure limit request shall be submitted to the EPA based on Step Rate Test results.

1. Notify the EPA to witness Step Rate Test (SRT) 30 days prior to execution.

2. MIRU a high pressure injection pump equipped with digital rate/pressure recorders. Manifold pump to pull produced water from existing SWD line, and to pressure and monitor well csg and tbg. Pressure csg to 200# and monitor throughout SRT.

3. Establish injection down the tbg at rate sufficient to stabilize injection pressure @ 500#. After 5 minutes, increase rate by ~0.5 BPM and maintain rate until tubing pressure is stable for at least 5 minutes.

4. Continue stepping up injection rate in 0.5 BPM increments and obtaining stabilized tubing pressures until pressure slope changes clearly indicate formation fracture has occurred or until a maximum STP of 3,300# (1.25 psi/ft injection gradient) is achieved. Terminate testing, RDMO pump equipment, and return well to SWD service.

5. Submit SRT data and injection pressure limit request to the EPA no later than 30 days after test completion.